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Original article

Prevalence of risk factors for falls among elderly people living in long-term care homes

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ABSTRACT

Background: Falls are common among the geriatric population, causing frequent morbidity and mortality. There is an increased risk of fall among older people living in long-term care homes. Identifying risk factors for falls among older people living in old-age homes can help in the care and prevention of falls in this population.

Aim: To evaluate the prevalence of various risk factors for falls among older people living in long-term care homes.

Methods: A total of 163 elderly men and women aged 60–95 years were studied. History of falls revealed by participants, Long Term Care Fall Risk Assessment Form, Mini Mental State Examination, Berg Balance Scale, Fall Factors Assessment Form, and Dynamic Gait Index were used as the assessment tools in this study. The odds ratio for the risk factors for falls was calculated. The association between the risk of fall and the risk factors was assessed using the χ^2 test. The degree of functional disability between the high-risk and low-risk groups was analyzed using an independent t test.

Results: The following risk factors were significantly associated will falls: poor vision [odds ratio (OR) = 1.851], chronic conditions (OR = 1.633), vertigo (OR = 2.237), imbalance (OR = 3.105), fear of falling (OR = 3.227), and previous falls (OR = 5.661) (all $p < 0.001$). There was a significant difference between high-risk and low-risk groups for all functional and cognitive measures: Long Term Care Fall Risk Assessment ($t = 20.824$), Mini Mental State Examination ($t = -6.18$), Berg Balance Scale ($t = -12.59$) and Dynamic Gait Index ($t = -14.7$) (all $p < 0.001$).

Conclusion: We found that history of falls, poor vision, use of multiple medications, chronic diseases, use of walking aids, vertigo, and balance problems were associated with falls among the elderly population living in long-term care homes. Women had a higher risk of falls than men.

1. Introduction

In India, the geriatric population is expected to increase from 76.6 million in 2006 to 173.1 in 2026.[1] This segment of the population faces multiple problems in India. Medical and psychological problems are considered to be disabling for the elderly population. Falls are considered one of the more serious problems among all age groups. A fall is defined as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change to the rest in furniture, wall, or other objects."[2] It is a common geriatric syndrome leading to morbidity and mortality. Recurrent falls are an important cause of morbidity and mortality in the elderly and are a marker of poor physical and cognitive status. In India, the prevalence of falls has been estimated as 14–53%.[3] Evaluation of the fall profile, the impact of various factors on falls, and their impact on function are an essential part of comprehensive assessment by physiotherapists for providing fall prevention care in the elderly population. There are several intrinsic and extrinsic factors considered responsible for falls in elderly people. Important factors are weakness, arthritis, history of falls, impaired activities of daily living, gait deficit, depression, balance deficit, cognitive impairment, use of assistive devices, age > 80 years, visual deficits, medications (certain psychiatric drugs, antiarrhythmic drugs, combination of > 4 drugs), neurological deficits (affecting cerebellum, basal ganglia and peripheral nerves, and reduced sensation

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and proprioception) cardiovascular deficits, and physical and social environmental conditions such as poor light and slippery or uneven surfaces.[2,4–6]

Typically, elderly people tend to live with their family, alone in their residence, or due to changing social attitudes of reduced care, some of them live in long-term care homes.[7–9] Although falls are common among the elderly population, recent research conducted in Kerala State, India, has found a greater increase in falls in elderly women residing in long-term care homes compared with women living in the community.[10] This has created a need to investigate various factors involved in the risk of falls among men and women living in geriatric care homes and to categorize the elderly people into those with a high and low risk of falling.

2. Methods

2.1. Participants

This was a cross-sectional study in four geriatric homes in Nagpur, Maharashtra State, and Bangalore, Karnataka State, India. Men and women aged $\geq$ 60 years, able to move indoors with or without walking aids, and not receiving any physiotherapy or any other training for physical fitness were included. Men and women not able to walk with or without assistive devices, with severe medical problems, and uncooperative individuals were excluded. A total of 163 participants were enrolled after screening for eligibility. Informed consent was obtained from every participant. Their basic demographic details were collected. A single assessment was done in their own geriatric home set up. Assessments were carried out by a qualified physiotherapist. Every participant received a questionnaire. The participants were instructed to fill in the forms and the physiotherapist assisted with completion when necessary. The questions included: (1) history of any falling incident as remembered by the participant; (2) sociodemographic data including age, height, weight, income, educational qualifications, marital status, and medical history; and (3) risk factors for falls including using a cane or walker, a fall during the past 3 months, acute or chronic illness, types and numbers of drugs, and physical deficits (balance and gait disorders, weakness, pain related to arthritis, visual and auditory impairment, epilepsy, parkinsonism, vertigo, syncope, dizziness upon standing, foot problems, difficulty rising from a chair, fear of falling).

2.2. Equipment

An armless wooden chair, a measuring tape, a weighing machine, a sphygmomanometer, a stethoscope, a stop watch, and a shoebox were used to conduct the assessments.

2.3. Assessment tools

The Long Term Care Fall Risk Assessment Form, Mini Mental State Examination, Berg Balance Scale, and Dynamic Gait Index were used as the assessment tools in this study.

2.3.1. Long Term Care Fall Risk Assessment Form

There were eight subtests to the Long Term Care Fall Risk Assessment Form[11]: level of consciousness/mental status, history of falls in past 3 months, ambulation/elimination status, vision status, gait/balance, systolic blood pressure, medication, and predisposing diseases. If the participant's score was < 10, he/she was classified into the low-risk group, and into the high-risk group if the score is > 10.

2.3.2. Berg Balance Scale

The Berg Balance Scale[12] contained 14 tasks to perform that were graded from 0 (unable) to 4 (independent), with a maximum score of 56. A higher score indicated better performance. Berg et al suggested that scores < 45 indicates that a participant is impaired, with an increased risk of falls.

2.3.3. Dynamic Gait Index

The Dynamic Gait Index[13] consisted of eight subtests. Each task was scored on a 4-point scale: 0, poor and 3, excellent. The maximum score was 24. Scores of $\leq$ 19 were related to increased incidence of falls in elderly people.

2.3.4. Mini Mental State Examination

The Mini Mental State Examination[14] was an 11-question measure that tested five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The maximum score was 30. A score of $\leq$ 23 was indicative of cognitive impairment.

2.4. Data analysis

Data were analyzed using SPSS Version 16.0. (SPSS Inc., Chicago) Frequency distributions and descriptive statistics were analyzed to characterize the study sample. The association between the risk of falling and various risk factors, namely, poor vision, history of falling, postural hypotension, use of medication, chronic diseases, use of waking aids, vertigo, imbalance, fear of falling, hearing impairment, and acute medical problems was assessed using the χ^2 test, and the extent of risk was expressed using odds ratio (OR). The continuous variables, such as degree of functional disability between the high-risk and low-risk groups, were analyzed using independent samples t test.

3. Results

The age of participants ranged from 60 years to 95 years (mean 74.61 ± 8.465 years; 75.46 ± 8.819 years for men and 73.86 ± 8.121 years for women). Body height ranged from 114 cm to 176 cm (mean 153.11 ± 10.341 cm; 160.46 ± 7.382 cm for men and 145.69 ± 8.028 cm for women; $t = 11.341$, $p = 0.000$). Body weight ranged from 25 kg to 80 kg (mean 53.61 ± 11.391 kg; 57.03 ± 10.138 kg for men and 50.63 ± 11.641 kg for women; $t = 3.714$, $p < 0.001$) (Table 1).

Thirteen men had 24 falls and 34 women had 81 falls. Based on the total scores obtained in the Long Term Care Fall Risk Assessment, the participants were divided into high-risk and low-risk groups. If the total score was < 10, he/she was classified as low risk for falling, and if the score was > 10, he/she was classified as high risk for falling. Among 163 participants, 116 (71.1%) did not have any history of falls before the assessment, and 47 (28.9%) participants had at least one fall. There was a total of 105 falls.

In the high-risk group, there were 21 (34.4%) men and 40 (65.6%) women. In the low-risk group, there were 55 (54%) men and 47 (46%) women (Table 2). The various risk factors observed in this study are listed in Table 3 and Figure.1.

There was a significant difference between the high-risk and low-risk groups for functional and cognitive outcomes ($p < 0.001$): Long Term Fall Risk Assessment, high-risk group 13.26 ± 2.714, low-risk group 4.3 ± 2.624 ($t = 20.824$); Mini Mental State Examination, high-risk group 20.2 ± 5.42, low-risk group 24.52 ± 3.3 ($t = -6.18$); Berg Balance Scale, high-risk group 38.52 ± 9.61, low-risk group 52.4 ± 4.36 ($t = -12.59$); Dynamic Gait Index, high-risk group 12.24 ± 5.29, low-risk group 21.91 ± 3.09 ($t = -14.7$) (Table 4).

Table 1
Characteristics of study participants.

Sno	Category		Male	Female
1	Sex		76 (46.6)	87 (53.3)
	Age (y)		75.46 ± 8.819	73.86 ± 8.121
	Height (cm)		160.46 ± 7.382	145.69 ± 8.028
	Weight (kg)		57.03 ± 10.138	50.63 ± 11.641
2	Education	Illiterate	10 (13.10)	22 (25.28)
		School	51 (67.10)	44 (50.57)
		College	15 (19.73)	21 (24.14)
3	Marital status	Married	26 (34.21)	14 (16.10)
		Unmarried	14 (18.24)	7 (8.04)
		Widow/widower	32 (42.10)	62 (71.26)
		Divorced	4 (5.26)	4 (4.60)
4	Socioeconomicsl status	Low (monthly income < Rs 2000)	62 (82)	50 (57.47)
		Medium–high (monthly income > Rs 2000)	14 (18)	37 (42.52)
5	Smoking		26 (34.21)	—
6	Alcoholism		66 (7.90)	—
7	Tobacco use		11 (14.47)	2 (2.30)

Data are presented as *n* (%) or mean ± SD.
SD = standard deviation; Sno = Serial numbers.

Calculated ORs to find the association between the risk factors and falling are given in Table 5.

4. Discussion

The aim of the study was to analyze various factors responsible for falls among institutionalized elderly people. A total of 163 elderly men and women were assessed from four different geriatric homes. The results show that prevalence of falling was higher among women than men. This study found that there was a significant difference in the severity of the problems identified as risk factors for falling between the high-risk and low-risk groups. According to a World Health Organization report, about one-fifth of fall-related deaths in 2004 (total 424,000) occurred in India.[15] We attempted to analyze the factors associated with falls among the institutionalized elderly population. The results showed that more women had a history of falling than men. Many other studies found similar results.[16–18] Among female fallers, the percentage is high in those living in long-term care homes.[19]

We showed that there is a strong association of falls with history of falling, poor vision, use of multiple medications, chronic diseases, use of walking aids, vertigo, and imbalance (Table 4). Similarly, a meta-analysis of 74 studies about the risk factors for falls confirmed this multifactorial etiology, with the strongest associations for history of falls (OR = 2.8 for all fallers; OR = 3.5 for recurrent fallers), gait problems (OR = 2.1; 2.2), walking aids use (OR = 2.2; 3.1), vertigo (OR = 1.8; 2.3), Parkinson's disease (OR = 2.7; 2.8), and antiepileptic drug use (OR = 1.9; 2.7).[20] Lord et al[21] found that 56% of falls occur outside the home (in the garden, street, footpath, or shops), while the remainder (44%) occur at various locations in the home. In contrast, we found that 87.5% of falls occurred at home and 12.5% occurred at various other locations. This may be because our population was from geriatric homes with restrictions on going out, and not from the community.

Most falls occur during periods of maximum activity in the morning or afternoon, and only approximately 20% occur between 9:00 PM and 07:00 AM.[22] We also found that 72.5% of falls occurred in the morning, 17.5% in the afternoon, 5% in the evening, and 5% during the night. This was because most falls occurred during activities of daily living and people were more active in the morning and afternoon compared with the evening and night-time.

In another Indian study conducted in Karnataka State, approximately 57% of elderly people with a history of falls were living in geriatric homes.[19] In an extensive review of factors and prevention strategies for falls among elderly people in India, it has been found that intrinsic factors such as reduced strength, poor balance, poor vision, reduced cognition, and chronic diseases and history of falls were the major risk factors for falling. “Bathroom” was reported as most common place of fall and the next common place was “road”. There may be many other psychological factors involved, like

Table 2
Falls profile.

		Male (%)	Female (%)
Falls		13 (17.1)	34 (39.1)
No. of falls		24	81
Group	High risk	21 (34.4)	40 (65.6)
	Low risk	55 (54)	47 (46)
Location	Inside home	87.5%	
	Outside home	12.5%	
Time	Morning	72.5%	
	Afternoon	17.5%	
	Evening	5%	
	Night	5%	

Table 3
Observed risk factors for falling.

Risk factor		Male *n* (%)	Female *n* (%)
Poor vision	Yes	33 (43.42)	51 (58.62)
	No	43 (56.58)	36 (41.38)
Postural hypotension	Yes	23 (30.26)	34 (39.08)
	No	53 (69.74)	53 (60.92)
Use of medication	Yes	42 (55.26)	55 (63.22)
	No	31 (40.79)	30 (34.48)
Chronic condition	Yes	43 (56.58)	70 (80.46)
	No	33 (43.42)	17 (19.54)
Uses a walking cane	Yes	17 (22.37)	11 (12.64)
	No	59 (77.63)	76 (87.36)
Vertigo	Yes	22 (28.95)	39 (44.83)
	No	54 (71.05)	48 (55.17)
Imbalance	Yes	23 (30.26)	47 (54.02)
	No	53 (69.74)	40 (45.98)
Fear of falling	Yes	18 (23.68)	42 (48.28)
	No	58 (76.32)	45 (51.72)
Hearing impairment	Yes	13 (17.11)	13 (14.94)
	No	63 (82.89)	74 (85.06)
Acute medical problem	Yes	5 (6.58)	4 (4.60)
	No	71 (93.42)	83 (95.40)
Fall in previous year	Yes	13 (17.11)	34 (39.08)
	No	63 (82.89)	53 (60.92)

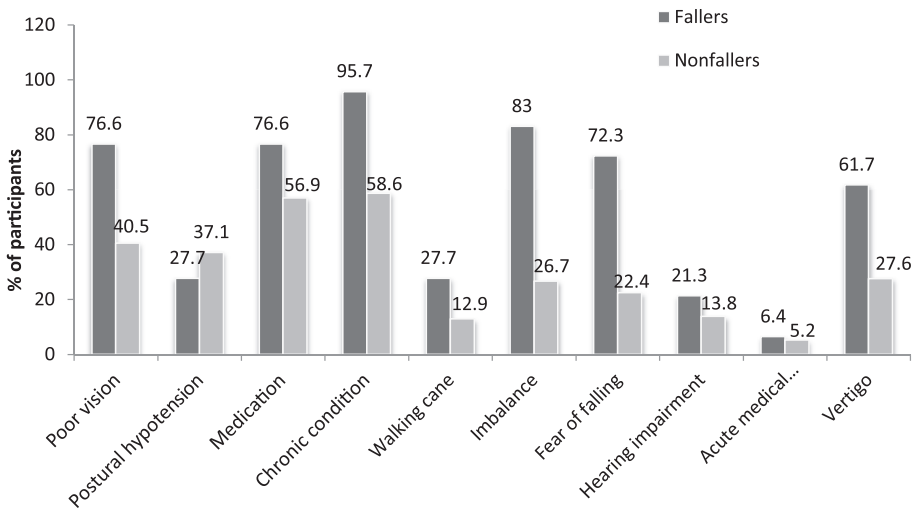

Figure 1. Risk factors for fallers.

Table 4
Comparison of outcome measures between high-risk and low-risk fallers.

Scales	High-risk group	Low-risk group	*t*	*p*
Long Term Fall Risk Assessment	13.26±2.714	4.3±2.624	20.824	<0.001*
Mini Mental State	20.2±5.42	24.52±3.3	−6.18	<0.001*
Berg Balance Scale	38.52±9.61	52.4±4.36	−12.59	<0.001*
Dynamic Gait Index	12.24±5.29	21.91±3.09	−14.7	<0.001*

Data are presented as mean ± standard deviation.
* Significant difference with $p < 0.001$.

depression, dementia, or feelings of guilt or depressed mood because of urinary incontinence.[3] As older individuals living in care homes are separated from family members, living in a restricted environment may have an adverse psychosocial effect, which has not been estimated adequately. Many other personal activities like sitting with crossed legs on the floor for taking food and performing prayers are cultural practices followed in India. This can cause a risk of falling as there is a tendency to fall while getting up from the floor, which requires good balance and strength. It is well established that certain factors are common among elderly people

Table 5
Association of risk factors for fallers.

Risk factors		Fallers *n* (%)	Nonfallers *n* (%)	χ^2	OR	*p*
Sex	Male	13 (17.10)	63 (82.90)	9.546	1.583	0.003*
	Female	34 (39.08)	53 (60.92)			
Poor vision	Yes	36 (22.08)	48 (29.45)	16.608	1.851	<0.001*
	No	11 (6.75)	68 (47.72)			
Postural hypotension	Yes	14 (8.59)	43 (26.38)	0.78	0.804	0.469
	No	33 (20.25)	73 (44.79)			
Use of medication	Yes	35 (21.47)	62 (38.04)	5.912	1.374	0.019
	No	11 (6.75)	52 (31.90)			
Chronic condition	Yes	45 (27.61)	68 (41.72)	21.677	1.633	<0.001*
	No	2 (1.23)	48 (29.45)			
Uses a walking cane	Yes	13 (7.98)	15 (9.20)	5.1	2.139	0.037
	No	34 (20.86)	101 (61.96)			
Vertigo	Yes	29 (17.79)	32 (19.63)	16.624	2.237	<0.001*
	No	18 (11.04)	84 (51.53)			
Imbalance	Yes	39 (23.93)	31 (19.02)	43.199	3.105	<0.001*
	No	8 (4.91)	85 (52.15)			
Fear of falling	Yes	34 (20.86)	26 (15.95)	35.844	3.227	<0.001*
	No	37 (22.70)	100 (61.35)			
Hearing impairment	Yes	10 (6.13)	16 (9.81)	1.397	1.543	0.245
	No					
Acute medical problem	Yes	3 (1.84)	6 (3.68)	0.094	1.234	0.718
	No	44 (27.00)	110 (67.48)			
Fall in previous year	Yes	23 (14.11)	11 (6.75)	36.783	5.661	<0.001*
	No	18 (11.04)	100 (61.35)			

OR = odds ratio.

designated as fallers. The common factors identified are: sex; race; age-related decline in strength, balance, vision and cognition; chronic diseases; a history of falling; risky behavior such as hurrying, sedentary lifestyle, and multiple medications; low income; low educational level; inadequate housing; limited access to health care services; and physical environmental features in the home or community that may pose hazards, such as slippery or uneven surfaces, steps, and poor building design.[2,4–6,20]

We found a strong association between falling and history of falling, poor vision, use of multiple medications, chronic diseases, use of walking aids, vertigo, and imbalance. These factors are common in fallers living in the community as well as in care homes. There could be different factors specific for elderly people living in long-term care homes. These factors need to be identified through various other assessment tools. In future, studies should specifically try to focus on evaluation of risk factors unique to care-home residents. Because they are living in isolation, away from family members, inability bear the cost of medical care and reduced physical activity may be factors that make this group of people vulnerable to falling. Indian studies to survey psychiatric morbidity found that the prevalence of depression, anxiety, mood disorders, and dementia were common among older people living in care homes.[23,24]

Instrumental assessment of risk of falling, such as dynamic posturography,[25] can be included in the assessment protocol to detect the risk of falling, because those measures are valid and can predict risk of fall earlier.

This study exclusively analyzed people living in long-term care homes. It adds additional strength to our study.

Lack of instrumental and psychological assessment tools and lack of a comparison group in the community were the limitations of this study.

In conclusion, we found that history of falling, poor vision, use of multiple medications, chronic diseases, use of walking aids, vertigo, and balance problems were risk factors associated with falling among elderly people living in long-term care homes. Women had a higher risk of falling than men. Risk factors for falling unique to the elderly population living in long-term care homes need to be assessed in future studies using specific measures like psychological assessment and laboratory measures. Our results can be used for future research and planning of effective strategies to prevent falls among older people living in long-term care homes.

Conflicts of interest

The authors declare no conflicts of interest.

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